Effect of spring-pruning method, copper sprays and training systems on bacterial canker of sweet cherry

Hatch Project CRIS Report 10/01/2007 to 09/30/2008 (filed online 1/9/2009) with added charts

Participants

Juliet Carroll, Senior Extension Associate, New York State IPM Program. Her role is principal investigator. She lead research efforts in two field experiments, two laboratory experiments, the collection and identification of Pss isolates and provided overall coordination of the project.
Terence Robinson, Professor, Horticultural Sciences. His role is co-principal investigator. He provided and maintained experimental orchards, pruning and spraying of two field experiments, and input on direction of research.
Thomas Burr, Professor, Plant Pathology and Plant-Microbe Biology. His role is co-principal investigator. He provided research laboratory facilities and equipment, guidance on bacterial laboratory work and input on direction of research.
Stephen Hoying, Senior Extension Associate, Horticultural Sciences. His role is co-principal investigator. He provided input on direction of research.
Theodora Bucien, Research Aide. She worked under the direction of Carroll providing technical support for field and laboratory experiments, maintained and identified cultures of bacterial isolates from the field, and assisted with data collection.

Collaborators

Kerik Cox, Assistant Professor, Plant Pathology and Plant-Microbe Biology. His role is collaboration on testing materials to substitute for copper in the management of bacterial canker and on the molecular genetics and identification of Pss isolates.
David Rosenberger, Professor, Plant Pathology and Plant-Microbe Biology. His role is collaboration on identification and awareness of outbreaks of bacterial canker in orchards in the Hudson Valley and input on direction of research.

Training

We have extended our knowledge of this disease through farm visits with the following farmers:
Mark Nicholson, Red Jacket Orchards, Geneva, NY
Steve Clarke, sweet cherry orchards, Milford, NY
Jeff Morris, Glenora Farms, Dundee, NY

Target Audiences

Sweet and tart cherry growers are the target audiences, in New York, the USA, and worldwide where this disease threatens cherry production. New York ranks fourth in the nation in tart cherry production with 2000 acres producing 7.5 million pounds of fruit valued at 3.24 million dollars. New York farmers grew 700 acres of sweet cherries producing 800 tons of fruit valued at 1.27 million dollars in 2005. New York tree fruit growers ranked the need for research on bacterial canker biology and management in the top ten.

Outputs

Activities: Efficacy of copper sprays to protect pruning wounds from bacterial canker infection was examined on 8-yr-old sweet cherry cv Hedelfingen, trained to a Vertical Axis System, in 3

replicate blocks, 15 trees/block. Copper (COCS and Bravo) was applied before and after pruning in spring. Of two (3- to 5-cm diam) branches pruned per tree, leaving 15-cm-long stubs, one stub was shielded from copper by wrapping with plastic. In another copper exclusion experiment on 16 Hedelfingen in 3 blocks, the fate of inoculations with copper-sensitive Psuedomonas syringae pv. syringae (Pss) on stub versus flush cuts was compared. Isolations from the copper-treated or untreated pruning stubs and flush cuts were made 2 and 4 weeks post-inoculation. Pss was identified by green fluorescence on Pseudomonas Agar F, negative cytochrome oxidase, utilization of esculin, pathogenicity on green cherry fruit, and PCR amplification of Pss-specific DNA. Isolates were screened for sensitivity to copper on media amended with 0.25 mg cupric sulfate per ml. A third field experiment on three replicate, one-tree blocks of cvs Lapins and Sweetheart was conducted to test the efficacy of phosphite or copper against leaf scar infections on two Pss-inoculated and two uninoculated branches per tree. Bacterial canker symptom development was assessed every two weeks from April to October. Laboratory experiments with detached shoots and green cherry fruit were conducted to determine pre-infection and post-infection activity of copper hydroxide, phosphite with Pentra Bark, kasugamycin and biological MOI-106. Data is currently being subjected to statistical analysis. The relative susceptibility of six sweet cherry orchard planting systems (Modified Central Leader, Spanish Bush, Marchant, Perpendicular V System, Vogel Slender Spindle, and Vertical Axis), five cultivars (Sweetheart, Lapins, Tehranivee, Hedelfingen, and Regina) and three rootstocks (Gi5, Gi6, and MxM2) for predisposition to bacterial canker in three replicate blocks will be evaluated this winter and differences in canker severity among the training systems, cultivars and rootstock/scion combinations will be compared statistically.

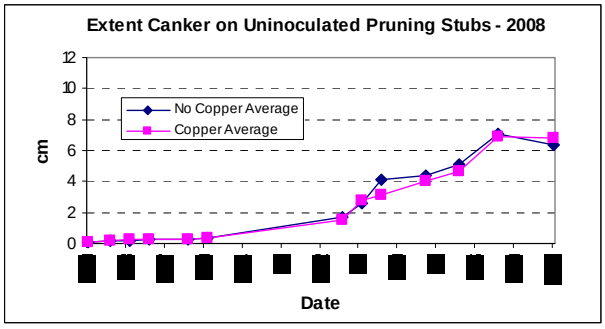
Services: Two farms were visited to assess the presence and impact of bacterial canker on sweet cherry. At Red Jacket Orchards, Geneva NY a new planting had a high number of dead and dying trees and there was some indication of bacterial canker but it was not the main problem. At Clarke's orchard, Milton, NY a severe outbreak of bacterial canker occurred on cv Schmidt following post-harvest summer bench pruning. Isolations were made from these trees and Pss confirmed.

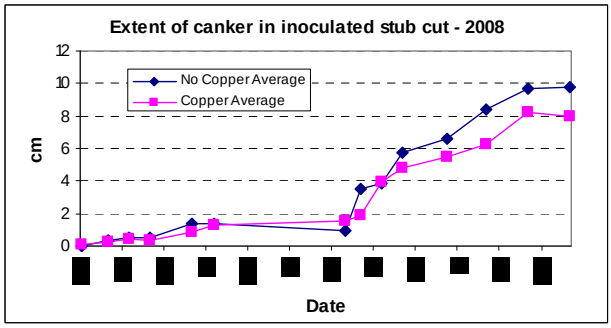
Products: We have new knowledge that copper provides little protection against bacterial infections of pruning cuts on sweet cherry, that copper resistance in the pathogen is not a contributing factor in lack of control, and that pruning stubs may effectively contain bacterial canker infections. We have a strong collaboration with Kerik Cox expanding the future scope of the project. We have a physical collection of 420 bacterial isolates. We have a second, 5-yr-old, experimental orchard for 2009 in Highland, NY.

Outcomes / Impacts

In field experiments on Hedelfingen we found copper provided 4.4% control of bacterial canker on uninoculated and 18% control on inoculated pruning stubs. Gummosis on pruning wounds was similar across treatments and types of cuts. A slight increase in gummosis levels was found on copper-treated stubs in both inoculated and uninoculated experiments. Comparable numbers of uninoculated pruning stubs produced lateral shoots whether treated (50%) or untreated (52.5%) with copper. Lateral shoot development on pruning stubs that were inoculated was more prevalent with copper treatment (37.5%) versus untreated (25%) and less frequent than from uninoculated stubs. Pss was re-isolated from all inoculated stub and flush cuts. None of the Pss isolates were resistant to copper. Flush cuts were as likely to become infected as stub cuts, but stub infections did not progress into proximal branches, scaffolds or trunks. Visual ratings of

flush cuts for canker proved difficult. Branch dissections showed that extent of discoloration was comparable in flush cuts and stub cuts, whether treated with copper (11.0 cm vs. 10.2 cm, respectively) or untreated (8.9 cm vs. 12.1 cm). In the field experiment testing of phosphite or copper against leaf scar infections, no differences in the numbers of blasted buds were observed between treatments or between varieties Lapins or Sweetheart. However, twice as many (26 out of 300) blasted buds were seen on inoculated branches as on those uninoculated (13 out of 300). One of three detached shoot experiments provided some evidence of pre-inoculation control of shoot invasion, with copper hydroxide providing 18% control, kasugamycin 33%, and phosphite with Pentra Bark and the MOI-106 biological 55%. In post-inoculation applications one of three experiments provided evidence of activity, with the MOI-106 biological providing 10% control, phosphite with Pentra Bark 13%, copper hydroxide 29%, and kasugamycin 38%. Screening these materials for activity in green cherry fruit in a single pre-inoculation experiment showed that copper hydroxide can reduce lesion expansion by 82%, the MOI-106 biological by 21%, and phosphite with Pentra Bark or kasugamycin by only 9%. In a single post-inoculation experiment on green cherry fruit kasugamycin reduced lesion size by 48%, the MOI-106 biological by 29%, copper hydroxide by 19%, and phosphite with Pentra Bark by 14%. We have developed knowledge that copper provides little protection against bacterial infections of pruning cuts on sweet cherry, that copper resistance in the pathogen is not a contributing factor in lack of control in the experimental orchard, and that pruning stubs may effectively contain bacterial canker infections. We successfully initiated new screening tests to identify materials effective against bacterial canker. Future field experiments are being designed to explore pruning at different times during the growing season and redesigned to further explore the effect of eliminating copper treatment.





Publications

Carroll, J.E., Robinson, T.L., and Burr, T.J. 2007. Contributions of copper sprays, pruning stubs, training system and cultivar towards management of Pseudomonas-incited cankers on sweet cherry. Phytopathology 97: S18.